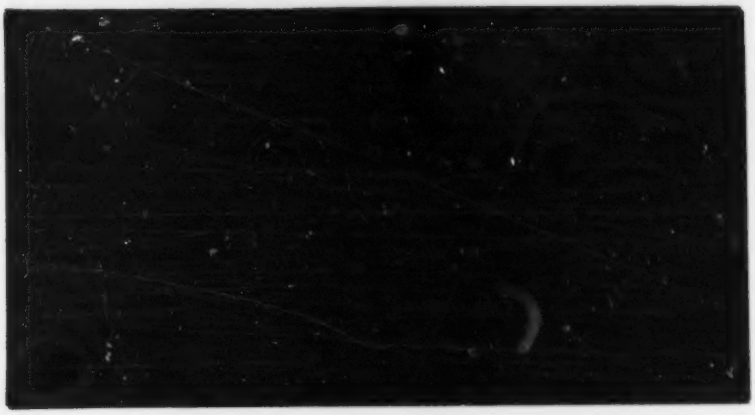
Upper Assiniboine River Basin Study



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Manitoba Conservation

101-01929/

Upper Assiniboine River Basin Study

Appendix E

GIS and Data Standards Committee Report

August 2000

Executive Summary

The Geographic Information Systems and Data Standards Committee was one of five technical committees in the Upper Assiniboine River Basin Study. The Committee had three main responsibilities within its advisory role.

The primary responsibility was to create data standards for the information generated and utilized in the Study, with consideration to existing and future data uses. The Committee made data standard recommendations for projection and datum, Geographic Information Systems (GIS), imagery and graphics.

The second responsibility was to assist in the selection of criteria for spatial data tenders and to evaluate resulting contractor bids. The GIS Data and Standards Committee managed two data contracts on behalf of the Study - a contract for satellite imagery from Ducks Unlimited Canada and a contract for scanned historic national topographic survey data from a private contractor.

The third responsibility was to advise on technical data issues. Recommendations to resolve technical problems were provided upon request and included topics such as cost estimates for data acquisition, data storage and processing, data licensing, and data distribution.

The Committee also promoted GIS and informed both public and Study participants about GIS/spatial data and analysis. The Committee also performed some of the early GIS analysis for the Study.

The Committee recommends that:

- The final use of data sets must be an integral part of the planning process. The end users must be aware of resolution and geo-referencing implications before acquiring any data if the GIS data from different sources are to be compared spatially.

- Data licensing must be taken into account when planning the final use of data sets. Data sets from most organizations have licensing agreements. Arranging broad-distribution data licenses can be expensive and time-consuming. A process to deal with data requests and to arrange data licence agreements should be developed following the Study.

- A centralized, structured library model for processing and storage data works well. The system facilitates setting and maintaining data standards.

- The .pdf file format is a suitable format for distributing GIS graphics. Color and clarity are good and file sizes are minimal which makes for easy digital document transfer.

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1 Introduction

The Geographic Information Systems (GIS) and Data Standards Committee is one of five technical committees of the Upper Assiniboine River Basin Study (UARBS). The Committee was established to define guidelines and standards for GIS analysis and for all other digital data to be used in the Study.

The governments of Saskatchewan, Manitoba and Canada agreed to undertake a comprehensive water management study of the Upper Assiniboine River Basin in eastern Saskatchewan and western Manitoba. The Study area includes the entire Basin in Saskatchewan and Manitoba north of the Qu'Appelle River. This portion of the Basin has a drainage area of 21,000 km^2 of which 79 percent is in Saskatchewan (Figure 2.1). The Study was a response to public demand for the resolution of the diverse and persistent water management issues in the Basin. Water related issues include conflict between agricultural drainage interests and downstream flooding, uncertainty over water supplies, concerns over the disappearance of wetland and wildlife habitat, and complaints linked to the quality of the Basin's water bodies and aquifers. The Study was to develop a water management framework to guide future water management in the Basin to resolve these issues.

The Study was initiated in October 1996 by an agreement between the governments of Saskatchewan (represented by Sask Water), Manitoba (represented by the Manitoba Conservation), and Canada (represented by Environment Canada) in October 1996. Many other private citizens, consultants, and agencies (including the Prairie Farm Rehabilitation Administration, Ducks Unlimited Canada, Manitoba Agriculture and Food, Manitoba Industry and Trade, Manitoba Intergovernmental Affairs, Saskatchewan Agriculture and Food, Saskatchewan Environment and Resource Management, Saskatchewan Wetlands Conservation Corporation, and Saskatchewan Municipal Affairs, Culture and Housing) contributed to this Study. Study work was undertaken by five technical committees, a strategy committee and supported by a communication committee. Public involvement was a vital component of the Study and was facilitated through six local watershed committees.

In 1996, Sask Water hired a consultant to do a pilot study on data requirements and Geographic Information Systems (GIS) analysis methods for a small area within the Basin. In March 1997, six months after the start of the Study, the GIS Data and Standards Committee (Appendix I) was created.

1.1 Committee Roles and Responsibilities

The Committee was intended to serve as an advisory group. However, because many components of the Study were based on GIS and digital data, the role of the Committee expanded beyond its terms of reference. One of the largest roles that evolved as the Study continued was to communicate to both Study and public participants information on GIS, its benefits and limitations, and the limitations of spatial data. Terminology associated with this data management and spatial analysis technology has been included in the glossary to this report.

Successful applications of GIS to water management, especially on the Prairies, were largely unknown. There were a number of challenges to be overcome in learning to apply this new technology especially in a limited time frame and in conjunction with adapting a new hydrologic model (SLURP) to the Basin.

In November 1997, the Prairie Farm Rehabilitation Administration (PFRA) GIS Unit was contracted by Sask Water to conduct the GIS analysis for the Study. A close working relationship between this Committee and the PFRA GIS Unit was maintained and this Committee occasionally performed some secondary analysis and some graphics production.

The Committee had three main responsibilities (see also Appendix II):

- the creation of data standards;
- the evaluation of data contracts; and
- advising Management Committee and the Study directors on technical data standard issues.

The Committee fulfilled these responsibilities and the results are discussed below in sections two to seven.

2 Data Standards

The Committee's primary responsibility was to create data standards for information used in the Study with consideration for current and future data uses. As a first step to setting standards, the Committee did a phone survey to determine what computer systems and applications Study participants were using and would most likely use at the end of the Study. The survey indicated that almost all Study participants were using Windows-based personal computers and, for operational and distribution purposes, no potential problems resulting from computer platforms were identified. The Committee recommended the following data standards.

2.1 Projection/Datum

A standard projection and datum were needed for the Study to allow all spatial data to be viewed in the same reference system. The Universal Transverse Mercator Zone 13 (UTM13) projection and the 1983 North American Datum (NAD83) were chosen as the reference system. A positive characteristic of the UTM projection is that it represents area with minimal spatial distortion. In general, distortion is minimal and it increases with distance from the center of the zone and is greatest at the margins. Data from different UTM zones cannot be presented together unless the data are projected into a common projection because error increases with distance from the center of the common projection. As the bulk of the digital data sets for the Study area fell within UTM13, it was chosen as the common projection (Figure 2.1). The data in UTM14 were converted to UTM13.

2.2 Geographic Information Systems

The Environmental Systems Research Institute (ESRI) exchange file format (.e00) was set as the file format for distributing GIS data. All current and future users indicated that they would be using the ESRI product suite of GIS software (either ArcView or ARC/INFO). Choosing the .e00 file format as the standard allowed maximum distribution flexibility. GIS file standards by type include:

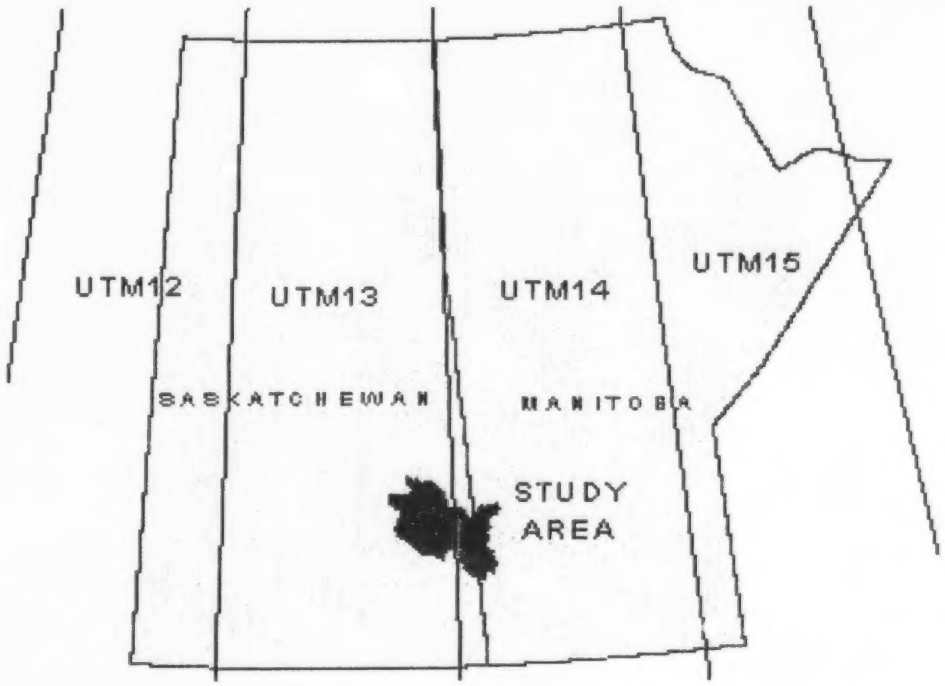
- For GIS vector data - the ARC/INFO export format (.e00) that can be read by ArcView 3. All data are to be in UTM13, NAD83.

- For GIS raster data (satellite imagery) - a format readable by ARC/INFO. Tagged Information File (.tif) format is preferred. Data preferred in UTM13, NAD83 but may be received in NAD27.

- For tabular data - to be received and distributed as a database (.dbf) file. Point data should have spatial coordinates associated with them.

- For global positioning system (GPS) data - to be received and distributed as a text (.txt) file. Data are to be in UTM13, NAD83.

Figure 2.1
The Study Area in Relation to Universal Transverse Mercator (UTM) Zones



2.3 Imagery

Receipt of imagery files was to be in a format readable by ARC/INFO. ARC/INFO is capable of reading a wide variety of imagery files, therefore no problems were expected or experienced. Files received and handled included .tif, .bsq, .bil, and .gis. Imagery files for distribution had to be readable by ArcView and again no problems were experienced. The PFRA GIS Unit was given the choice of .tif, .bsq, .bil, and GRID.

2.4 Graphics

The standardization of graphic formats was more problematic as there was a greater variety of users and several printing and distribution requirements. Several options were recommended for interim distribution and graphics were created in .jpg, .eps (level 2), and .pdf file formats. For final distribution, the Adobe Portable Document File (.pdf) format was recommended to, and accepted by, Management Committee. It adequately preserves the colors and clarity of the original maps. Adobe provides a freeware viewer that can be distributed along with the .pdf files on a compact disk (CD).

Standardized identification of Study agencies was accomplished by creating a logo for the Study. This logo was scanned and a .tif file created for use on all digital Study graphics.

3 Data Tenders and Contracts

The Committee assisted in the selection of criteria for spatial data tenders and evaluated resulting contractor bids. The GIS Data and Standards Committee managed two data contracts on behalf of the Study.

3.1 Classified Satellite Imagery

The first contract was with Ducks Unlimited Canada (DU) for wetlands land cover for the Study area. The data were derived from LANDSAT satellite imagery. Ready-to-use imagery is the culmination of many steps but the last two are of interest. After the data have been collected from the satellite, they are mathematically corrected and stored in large (roughly 100 km by 100 km) scenes. At this point the data are called raw imagery. A scene contains millions of data values, each of which represents the reflectance value of a small part of the earth's surface. These small areas are called cells and each square-shaped cell is 30 metres by 30 metres in size. To show patterns, the reflectance values of each cell must be grouped to represent land cover type and this process results in classified imagery. The imagery classified by DU to highlight wetlands was meant to augment the PFRA Western Grain Transition Payment Program (WGTPP) classified imagery. Both sets of imagery were from the LANDSAT satellite and were registered to the NTS map sheets (1:50 000 scale). The original agreement was for the imagery to be delivered in UTM13 projection, NAD83 datum but, because of difficulties in projecting datums at the time of data delivery, it was delivered in UTM13, NAD27. The contract data were delivered as four scenes (each satellite image is referred to as a scene). At the end of the Study, the data were converted to UTM13, NAD83.

3.2 Historic National Topographic Survey Maps

The second contract was an invitational tender for digitally scanned National Topographic Survey (NTS) data. The Committee evaluated two bids and awarded the contract on the basis of lowest bidder to CAD/CAM Solutions of Canada Incorporated. The contract required the delivery of digital data of selected themes from 65 first edition (circa 1960) NTS map sheets (1:50 000 scale). The selected themes were hydrography (rivers and lakes), vegetation (marsh), and vegetation (trees). The product was spot-checked by PFRA and Sask Water, and after minor revisions, it was agreed that the data met the specifications.

4 Technical Data Issues

4.1 Digital Elevation Model (DEM)

A pilot study was conducted by a consultant for the Study in 1996 (Trigon Mapping Resources and Saskatchewan Research Council, 1997). As part of this pilot, the Study purchased GXF format elevation data. These data were elevations for the centroids of 100 metre cells. The GXF data were not sufficiently detailed to produce a hydrologically correct surface. Eventually it was decided that the 100 metre cell resolution was too coarse to produce a digital elevation model (DEM) of sufficient resolution for the Study purposes. Therefore, the GXF data were eventually abandoned in favor of current (Edition 2, circa late 1980s) National Topographic Survey (NTS) elevation contours.

The NTS elevation contours are recorded in 10 metre or 25 foot contour intervals (depending on the map sheet) at the 1:50 000 scale. The contours and hydrography (coded with elevations) were used to build a DEM that simulated the correct surface hydrography of the Study area. The DEM was used as one of two critical data sets in the production of statistics for input to the SLURP hydrologic model. A more detailed discussion of the use of this data set for GIS analysis is provided in refer to the Drainage and Flood Control Committee Report, Upper Assiniboine River Basin Study, Appendix A.

4.2 Historic National Topographic Survey Maps

The choice of NTS maps as the source for historic land cover data was based on a recommendation in the pilot study report (Trigon Mapping Resources and Saskatchewan Research Council, 1997). Although detailed aerial photography was the preferred data source, the NTS maps were chosen solely on the basis of funding available for the Study. The Committee developed the contract delivery parameters and checked the delivered data for completeness and quality. Four land cover themes from first edition NTS map sheets (1:50 000 scale) were captured through a scanning process and were delivered as ARC/INFO GIS vector coverages. These data sets represented the land cover (hydrography, wetlands, and trees) circa the 1950s.

The historic NTS map sheets obtained for the scanning contract were originally created from air photos. It was assumed that the information printed on each map sheet identifying the source year of air photos was accurate. After the scanning was complete, the digital map sheets were compiled into one large digital coverage. Inconsistencies in features along map sheet edges (e.g., the two halves of a lake divided by the seam between two map sheets did not match) were discovered and this led to research on the source air photos. It was discovered that NTS map sheets were actually created from a mosaic of air photos of different scales and from different years and seasons. Generalization also led to inconsistencies.

Generalization, the cartographic process of smoothing out detail, was applied differently in many of the map sheets. All maps are a representation of the real world and, by necessity, data are generalized to yield a map at the required scale. Examples of generalization include drawing a gentle curve to represent a river that has many tight bends, or drawing one large area of marsh to represent many tiny areas. The generalization process has rules, but there is a significant subjective component. Generalization rules define how the features are identified and represented on map sheets at the scale in question. One very important definition is the size of the smallest sized feature that will be identified in the map (known as the minimum mapping unit). Documentation from the Mapping Services Branch of Natural Resources Canada (Natural Resources Canada,1961) indicated that minimum mapping units for the land cover themes on the historic NT map sheets were: lakes (22 meters in diameter), marsh/swamp (122 meters in diameter), and trees (122 meters in diameter). Of the four land cover themes from the NTS map sheets, trees and the hydrography arcs (rivers and streams) most closely represented the air photos. The hydrography polygons (lakes and sloughs) and the wetlands often poorly represented the air photos largely because of the generalization practice of lumping many small wetlands that appeared on the air photos into one large polygon on the NTS map sheets. This form of generalization greatly overestimates area.

The original intention was to evaluate land cover change over time by comparing area statistics from the historic land cover (from the historic NTS maps (section 4.2)) to area statistics from the current land cover (from the satellite imagery (section 4.3)). However, as the Study progressed, generalization in the NTS map sheets, scale differences, and feature definition differences between the NTS data and the satellite data proved to be significant technical issues. For nearly two and a half years, the Study tried various methods of comparison but ultimately the Study was able to produce limited usable change analysis results. Success was achieved with the trees land cover by comparing historic (circa late 1950s) NTS to current (circa late 1980s) NTS. The trees definition in both NTS datasets was consistent enough to allow a change analysis of trees for the Basin. For a more detailed discussion of the use of this data set for change analysis is provided in the Drainage and Flood Control Committee Report Upper Assiniboine River Basin Study Report, Appendix A and the Wetlands Committee Report Upper Assiniboine River Basin Study Report, Appendix C. For modeling purposes, only the current land cover data sets were usable as a representation of their respective time period. A more detailed discussion of the use of this data set for GIS analysis can be found in the Drainage and Flood Control Committee Report.

4.3 Satellite-derived

PFRA contributed the classified LANDSAT imagery (11-class) from the Western Grain Transition Payment Program (WGTPP) for use in the Study. This data set represented land cover in 1995 and was the second of two critical GIS data sets used to calculate statistics for input to the SLURP hydrologic model.

Ducks Unlimited Canada also provided classified LANDSAT satellite imagery to the Study. The DU imagery was classified to highlight wetlands only and was meant to augment the PFRA

WGTPP classified imagery. The Committee evaluated the feasibility of combining the two sets of imagery and found that there were too many technical problems with this approach and ultimately recommended against combining the two sets of imagery. The technical problems were primarily due to different classification methods. Although similar, the different classification methods yielded land cover themes that were not mutually exclusive. Overlap between various themes prevented automated theme combination. Manual combination was prohibitively expensive. More detailed discussion of the use of the satellite-derived data sets for GIS analysis is provided in the Drainage and Flood Control Committee Report and the Wetlands Committee Report of this Study.

4.4 Other Vector and Attribute Files

Various other line, point, polygon and attribute files were contributed by participating agencies. These data sets were evaluated on a case-by-case basis, error-checked as required, and were structured and placed into the Study GIS Data library. Table 5.1 lists the data by theme.

5 Data Storage and Processing

Data storage and processing of GIS data were done at the PFRA in Regina using ARC/INFO GIS and ArcView GIS. This Committee designed a digital library structure for processing and storing all the spatial data associated with the Study. Table 5.1 is an annotated listing of the GIS Library directory structure. The library contains nearly 1 GB (gigabyte) of data. At the conclusion of the Study, the source and final data were stored to tape and forwarded to Sask Water and Manitoba Conservation.

Table 5.1
Annotated GIS Data Library Structure

DATA COMPILED FOR THE STUDY	
DIRECTORY	**CONTENTS**
aml/	**processing amls**
avp/	**ArcView projects**
bdy/	**boundaries: e.g. provincial**
bio/	**biology data**
cen/	**census data**
cli/	**climate data**
dem/	**elevation data**
doc/	**documentation on the Study**
eco/	**ecoregions**
fab/	**township fabric, quarter section points**
gra/	**graphics for presentations e.g. Corel Draw, Power Point**
hyd/	**hydrographic data**
img/	**imagery**
lcv/	**land cover**
nts/	**NTS data, map sheet outlines**
ter/	**terrain: soils, geology**
trn/	**transportation**

DATA COMPILED FOR THE STUDY	
DIRECTORY	**CONTENTS**
twn/	**towns, cities**
wql/	**water quality data: landfill, lagoon, and chemical disposal depot locations**
wsh/	**watershed arcs, polygons, and hydrometric gauging stations**

Notes: Directories represent data themes. The data were originally stored and processed at AAFC - PFRA GIS UNIT. Original pathname: pfreg24/gis_dev/uarbs/lib/. Table 6.1 provides additional information on specific data sets.

6 Data Licensing and Data Distribution

A summary of data licensing agreements for the Study as of April 1999 was prepared. This section deals with the data that were used in the Study and the availability of the Study results. Study results are available both as hard copy reports and may also be available on compact disk (CD). Most of the Study data have licensing agreements associated with them, and therefore cannot be freely distributed. However, images of the data can be distributed freely and digital versions of the maps and other spatial analyses are being provided on the CD as Portable Document Files (.pdfs). These .pdfs are digital graphical representations of the data but no original data can be obtained from the .pdfs. To obtain original data, a request must be made to the Study (please contact Sask Water or Manitoba Conservation). Data cannot be released until data licensing agreements are reviewed, and, if necessary, new licensing agreements arranged with the agency or individual requesting data.

Basically, a data license agreement is a legal document that outlines the conditions of use of the data. A licensing agreement usually limits the use of the data to the organization purchasing the data. Many different agencies contributed data or provided data for a fee to the Study. In most cases, data were provided with a data license agreement that limited the use of the data to the Study. A new license agreement would have to be arranged to distribute data outside of the Study agencies. Table 6.1 is a summary of data used in the Study and the status of any licensing agreement. This table is structured by data category. Descriptions include the data type, who provided the data, who received the data, and the licensing agreement status/restrictions. Arranging a data license agreement is a lengthy process and a GIS is required in order to use the original data.

Table 6.1
Data Licensing by Data Category

SPECIFIC DATA SETS				
DATA CATEGORY	**DATA SUPPLIED BY**	**DATA PRODUCT**	**DATA SUPPLIED TO**	**CURRENT LICENSING STATUS**
Elevation/ Physiographic	Consultant	GXF DEM	UARBS	Contract - study owns the data so no restrictions on distribution
Cultural/Surveyed Boundaries	Sask Geomatics	NTS	PFRA	Internal use only
		NTS	Sask Water	Licensed for use in the study but not for distribution

SPECIFIC DATA SETS				
DATA CATEGORY	**DATA SUPPLIED BY**	**DATA PRODUCT**	**DATA SUPPLIED TO**	**CURRENT LICENSING STATUS**
		Township Fabric	PFRA	Internal use only
	Linnet Geomatics	Township Fabric	PFRA	Internal use only
		Township Fabric	Sask Water	Internal use only
	PFRA	Township Fabric	PFRA	Internal use only
		NTS (from SaskGeomatics)	PFRA	Internal use only
		Various vector and point layers for creating maps	PFRA	Internal use only
	Manitoba Conservation	Land Tenure data	UARBS	No license, for use in the Study but not for redistribution
	SERM	Land Tenure data	PFRA	No license, for use in the Study but not for redistribution
	University of Regina(CPRC)	Land Tenure data	PFRA	Internal use only
Satellite Imagery	Ducks Unlimited	Classified Imagery	PFRA	For use in the Study but not for redistribution
	PFRA	WGTPP Imagery	UARBS	For use in the Study but not for redistribution
Hydroclimatic Data	Environment Canada	Hydroclimatic data sets for modelling	Sask Water	No license, for use in the Study but not for redistribution
Various Thematic Data	Ducks Unlimited	DU project location data	UARBS	For use in the Study but not for redistribution

SPECIFIC DATA SETS				
DATA CATEGORY	**DATA SUPPLIED BY**	**DATA PRODUCT**	**DATA SUPPLIED TO**	**CURRENT LICENSING STATUS**
		DU predicted waterfowl density and distribution	UARBS	For use in the Study but not for redistribution
	PFRA	Gross watershed boundaries	UARBS	No restrictions on redistribution
	SERM	Water quality sampling locations	UARBS	No license, for use in the Study but not for redistribution
Census Data	PFRA	Ag Census data for consultant's report	UARBS	Internal use only
	Statistics Canada	Population statistics	UARBS	pending

Note: CPRC - Canadian Plains Research Centre ; **DU** - Ducks Unlimited; **GXF DEM data** - Grid eXchange File, Digital Elevation Model; **NTS** - National Topographic Survey; **PFRA** - Prairie Farm Rehabilitation Association; **SERM** - Saskatchewan Environment and Resource Management; **UARBS** - Upper Assiniboine River Basin Study; **WGTPP** - Western Grain Transition Payment Program

7 Conclusions and Recommendations

The concept of a GIS and Data Standards Committee was sound. However, the Committee should have been implemented prior to acquiring the DEM, the NTS historic and the DU data sets. The issues surrounding data resolution, generalization, and geo-referencing may then have been identified, fully understood and averted.

The Study did novel research with new technology. With the assistance of GIS, a number of new data sets were assembled for the Basin. New data sets included a DEM and historic land cover themes. The DEM and land cover data sets were used for input to the SLURP hydrologic model. Lessons learned about data over the course of the Study include: NTS map sheets are often based on more years and scales of air photos than are stated on the map sheet, NTS map sheets have variable levels of feature definition and generalization, and it is difficult to compare data from the same source (e.g., NTS to NTS or satellite imagery to satellite imagery) but it is even more difficult to compare data sets from different sources.

The GIS and Data Standards Committee completed all of its responsibilities as outlined in the terms of reference. Data standards for the Study were set for both spatial data and for graphics. The GIS standards were accepted and monitoring and refereeing these standards was not necessary. The standardization of graphic formats was more problematic as there were a greater variety of users and several printing and distribution requirements. Several options were recommended and graphics were created in .jpg, .eps (level 2), and .pdf file formats. The Committee also advised the Study management on a variety of data-related issues including data storage and processing, data cataloguing, licensing of data, and data distribution.

The Committee makes the following recommendations:

- The final use of data sets must be an integral part of the planning process. The end users must be aware of resolution and geo-referencing implications before acquiring any data if the GIS data from different sources are to be compared spatially.

- Data licensing must be taken into account when planning the final use of data sets. Data sets from most organizations currently have licensing agreements. Arranging broad-distribution data licenses can be expensive and time-consuming. A process to deal with data requests and to arrange data licence agreements should be developed following the Study.

- A centralized structured data library model for processing and storage works well. The system facilitates setting and maintaining data standards.

- The .pdf file is presently a suitable format for distributing GIS graphics. Color and clarity are good and file sizes are minimal which makes for easy digital document transfer.

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Glossary

ARC/INFO - a GIS software product of ESRI. ARC/INFO is typically run on a UNIX computer.

ArcView - a GIS software product from ESRI. ArcView is designed for the personal computer and is less powerful than ARC/INFO.

datum - a horizontal reference system.

DEM - Digital Elevation Model. A DEM is comprised of evenly spaced points. Each point represents the average elevation of the cell (square area) around it. The resolution or the detail that the DEM is capable of representing is determined by the density of points, i.e., a DEM with more closely-spaced points is capable of more realistically representing the true surface than a DEM with less closely-spaced points.

DU - Ducks Unlimited Canada. A private organization that is concerned with preserving and enhancing waterfowl habitat.

eps - Encapsulated PostScript. Graphic file format.

ESRI - Environmental Systems Research Institute. A large international GIS company based out of Redlands California and the makers of ARC/INFO and ArcView GIS.

GIS - Geographic Information System. A computer system for collecting, storing, manipulating, analyzing, and presenting spatial and non-spatial data.

GPS - Global Positioning System. A network of satellites orbiting the earth that allows users on the earth's surface to accurately derive their location and elevation with a hand-held device.

GXF - Grid eXchange File. A file format that stores point elevations in a proprietary text file. The elevations represent a surface and may be built into a DEM.

jpg - Joint Projects Group. Graphics file format.

LANDSAT - a Canadian satellite that collects data in multiple wavelengths including visible and infrared. The data collected by LANDSAT are particularly useful in determining land cover types.

NAD27/NAD83 - North American Datum. Each is a separate horizontal datum for North America. The NAD83 datum is the more recent and the more accurate of the two.

NTS - National Topographic Survey. Refers both to the Canadian organization that produces topographic maps, and more generally to the topographic maps themselves. Topographic maps are produced at different scales and therefore present different levels of detail. Data commonly found on topographic maps are elevation, basic land cover types, hydrography, and cultural features.

pdf - Portable Document File. A digital file format from a company named Adobe. The file format preserves the look of the original document while removing the constraints of the original formatting. A user may print a .pdf file on whatever printer they have at whatever size they wish regardless of the printer that the original document was created for.

projection - a two-dimensional representation of a three-dimensional surface. Projections fall into three classes - cylindrical, azimuthal, or conic - and each can preserve any two characteristics of shape, angle, and distance, but not all three. Therefore maps of the same area produced with different projections may look different and convey different messages.

SLURP - Simple Lumped Reservoir Parameter. A semi-distributed hydrologic model developed by the Canadian Hydrologic Research Institute. This hydrologic model was used for The Study.

tif - Tagged Information File Format. Graphics file format.

UTM - Universal Transverse Mercator. A type of cylindrical projection that preserves shape and angles (Robinson et al. 1984).

Appendix I

GIS and Data Standards Committee Members

GIS and Data Standards Committee Members

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Appendix II

GIS and Data Standards Committee

Terms of Reference

Terms of Reference

The GIS and Data Standards Committee has been established to set and administer data standards for the Upper Assiniboine River Basin Study, and to maintain associated data sets. The Committee includes representation from Environment Canada, Saskatchewan Water Corporation, Manitoba Natural Resources and the Prairie Farm Rehabilitation Administration (PFRA).

Responsibilities:

- The primary responsibility of the Committee will be the creation of data standards for the information generated and utilized in the Study, with consideration to existing and future data uses. Monitoring and refereeing these standards will be an important and ongoing duty.
- The Committee will assist in the selection of criteria for spatial data tenders and will evaluate resulting contractor bids.
- The Committee will advise the Management Committee and the Study directors on technical data standard issues.
- The Committee will do the bulk of its work in the initial year of the project but will have an ongoing role throughout the three-year project.

Specific Duties:

- Determine the data users, and identifying all present and expected sources of data and their production platforms.
- Define the desired final data products. This will allow steady progress toward common goals without duplication of effort.
- Choose a GIS data standard. As much of the Study analysis will be processed with a GIS, it is crucial that a standard GIS format is chosen and that data conform to that format. Presently, multiple platforms running a variety of software (ArcInfo, ArcView, AutoCAD, AtlasGIS, and SPANS) are being used. The ArcInfo export format that can be read by ArcView 3 should be strongly considered as the GIS exchange file standard.
- Develop standards for data files. This will include standards for GIS files, CAD files, satellite imagery files, database files, and graphics files. Standards will be set for datums, projections, tolerances, compression and documentation.
- Related issues to be considered by the Committee include data storage and processing, modelling, data cataloguing, delivery standards and licensing of data. These issues include how and where data will be processed and stored, file naming conventions, file protections, compression, file transfer media and documentation.

March 14, 1997